

CLAIMS

What is claimed is:

5. 1. A home laundry machine, comprising:
a laundry enclosure; and
a drying mechanism pneumatically coupled to the laundry enclosure via an air inlet and an air outlet, comprising:
a heating device disposed upstream of the air inlet; and
10 a cooling device disposed downstream of the air outlet.
2. The home laundry machine of claim 1, wherein the laundry enclosure is adapted to clean laundry in a cleaning fluid.
- 15 3. The home laundry machine of claim 1, wherein the drying mechanism is adapted to recapture a desired portion of the cleaning fluid.
4. The home laundry machine of claim 3, wherein the desired portion comprises a cleaning solvent.
- 20 5. The home laundry machine of claim 1, comprising a cleaning solvent tank coupled to the laundry enclosure.
6. The home laundry machine of claim 5, wherein the cleaning solvent tank is adapted to retain a cleaning solvent comprising a siloxane.
- 25 7. The home laundry machine of claim 1, comprising an air conduit extending from the air outlet to the air inlet.

8. The home laundry machine of claim 7, comprising a blowing device adapted to flow air through a pneumatically closed air pathway extending through the air conduit, into the laundry enclosure from the air inlet, and out of the laundry enclosure through the air outlet.

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9. The home laundry machine of claim 1, comprising a condensate drain disposed adjacent the cooling device and coupled to a fluid recovery system.

10 10. The home laundry machine of claim 1, wherein the drying mechanism comprises a vapor compression cycle system in which the heating device comprises a condenser and the cooling device comprises an evaporator.

11. The home laundry machine of claim 10, wherein vapor compression cycle comprises a compressor and a pressure reducing mechanism.

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12. The home laundry machine of claim 1, comprising an agitation device coupled to the laundry enclosure.

20 13. The home laundry machine of claim 12, wherein the agitation device comprises a motor having a rotational shaft coupled to a rotational axis of the laundry enclosure.

14. The home laundry machine of claim 1, wherein the laundry enclosure is side-loadable.

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15. The home laundry machine of claim 1, wherein the laundry enclosure is top-loadable.

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16. A system for washing and drying laundry, comprising:
a laundry enclosure;

a cleaning fluid source coupled to the laundry enclosure;
a drying system coupled to the laundry enclosure, comprising;
a fluid recovery system coupled to the drying system and adapted to recover
vaporized cleaning fluid.

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17. The system of claim 16, wherein the laundry enclosure comprises a
rotatable receptacle coupled to a motor.

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18. The system of claim 16, wherein the cleaning fluid source comprises a
cleaning solvent tank.

19. The system of claim 16, wherein the cleaning fluid source comprises a
water source.

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20. The system of claim 16, wherein the drying system is adapted to
vaporize cleaning fluid from articles within the laundry enclosure and to condense the
vaporized cleaning fluid for recovery by the fluid recovery system.

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21. The system of claim 16, wherein the drying system and the laundry
enclosure define a closed-loop air passageway.

22. The system of claim 21, comprising a vapor compression cycle system
disposed along the closed-loop air passageway.

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23. The system of claim 21, wherein the drying system comprises at least
one heating device disposed upstream of the laundry enclosure and at least one cooling
device disposed downstream of the laundry enclosure.

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24. The system of claim 16, comprising a control system having energy
usage minimization parameters.

25. The system of claim 16, comprising a control system having wash time minimization parameters.

5 26. The system of claim 16, comprising a control system having dry time minimization parameters.

10 27. A laundry cleaning device, comprising:
an enclosure comprising a fluid inlet, a fluid outlet, an air inlet, and an air outlet;
a heating device pneumatically coupled to the air inlet;
an air cooling device pneumatically coupled to the air outlet; and
a cleaning control system comprising cycle time parameters and energy efficiency parameters for a home application.

15 28. The laundry cleaning device of claim 27, comprising a vapor compression cycle system in which the heating device comprises a condenser and the cooling device comprises an evaporator.

20 29. The laundry cleaning device of claim 27, wherein the enclosure and a conduit extending from the air outlet to the air inlet define a closed-loop air passageway.

25 30. The laundry cleaning device of claim 27, comprising a condensate drain disposed adjacent the air cooling device and operatively coupled to a fluid recovery system.

31. The laundry cleaning device of claim 27, wherein the cleaning control system comprises a wash cycle and a dry cycle.

32. The laundry cleaning device of claim 31, wherein the wash cycle comprises a cleaning fluid introduction stage and an enclosure agitation stage.

5 33. The laundry cleaning device of claim 31, wherein the dry cycle comprises a centrifugal fluid removal stage and a thermal fluid removal stage.

10 34. A laundry cleaning device, comprising:

means for washing laundry with a cleaning fluid; and
means for drying the laundry with an airflow; and
means for substantially recovering the cleaning fluid.

35. The laundry cleaning device of claim 34, wherein the means for washing laundry comprise a laundry enclosure and a cleaning solvent tank coupled to the laundry enclosure via a cleaning fluid inlet.

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36. The laundry cleaning device of claim 34, wherein the means for drying the laundry comprise a vapor compression cycle system.

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37. The laundry cleaning device of claim 34, wherein the means for substantially recovering the cleaning fluid comprise a condensate drain disposed adjacent a cooling device and coupled to a fluid recovery tank.

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38. A method for controlling a laundry cleaning device, comprising:
providing a washing cycle operable with a cleaning fluid;
providing a drying cycle operable with a heating device to vaporize the cleaning fluid and a cooling device to condense vaporized cleaning fluid; and
providing control parameters for substantially optimizing time and energy usage of the washing and drying cycles for a home application.

39. The method of claim 38, wherein providing control parameters comprises setting agitation time and agitation speed for the washing cycle.

5 40. The method of claim 38, wherein providing control parameters comprises setting a temperature of at least one of the heating device and the cooling device.

10 41. The method of claim 40, wherein setting a temperature comprises targeting a heated-air temperature greater than about 100 degrees Fahrenheit for the heating device.

15 42. The method of claim 40, wherein setting a temperature comprises targeting a heated-air temperature between approximately 130 and 170 degrees Fahrenheit for the heating device.

43. The method of claim 40, wherein setting a temperature comprises targeting a cooled-air temperature less than about 70 degrees Fahrenheit for the cooling device.

20 44. The method of claim 40, wherein setting a temperature comprises targeting a cooled-air temperature between approximately 50 and 80 degrees Fahrenheit for the cooling device.

25 45. The method of claim 38, wherein providing control parameters comprises setting an airflow rate.

46. The method of claim 45, wherein setting the airflow rate comprises targeting a flow rate of about 150 to 300 cubic feet per minute.

30 47. A method for operating a laundry cleaning device, comprising:

passing heated air into a laundry enclosure to vaporize a cleaning fluid; and
cooling the heated air exiting the laundry enclosure to condense vaporized
cleaning fluid from the heated air.

5 48. The method of claim 47, comprising introducing the cleaning fluid into
the laundry enclosure and agitating the laundry enclosure.

49. The method of claim 47, comprising introducing the cleaning fluid into
the laundry enclosure to execute a solvent-based wash cycle.

10 50. The method of claim 47, comprising rotating the laundry enclosure at a
high speed adapted to centrifuge fluid out of articles disposed in the laundry enclosure.

15 51. The method of claim 47, wherein passing and cooling comprise blowing
an airflow through a pneumatically closed system.

20 52. The method of claim 47, wherein passing heated air comprises flowing
air through a condenser of a vapor compression cycle system and cooling the heated air
comprises flowing the heated air through an evaporator of the vapor compression cycle
system.

53. The method of claim 52, wherein passing heated air further comprises
heating the air with a supplemental heating device.

25 54. The method of claim 52, wherein cooling the heated air further
comprises chilling the heated air with a supplemental cooling device.

30 55. The method of claim 47, comprising rotating the laundry enclosure at a
low speed adapted to tumble articles disposed in the laundry enclosure to facilitate
vaporization of the cleaning fluid.

56. The method of claim 47, wherein cooling comprises substantially recovering the cleaning fluid for subsequent laundry cleaning.

5 57. A method of manufacturing a laundry cleaning device, comprising:
positioning a cooling device along an air exhaust passageway to condense vaporized cleaning fluid exhausted from a laundry enclosure; and
providing a cleaning fluid recovery system to recover cleaning fluid condensed by the cooling device.

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58. The method of claim 57, comprising positioning a heating device along an air inlet passageway to heat air entering the laundry enclosure.

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59. The method of claim 57, comprising extending the exhaust passageway to an air inlet passageway to form a closed-loop airflow passageway.

60. The method of claim 57, wherein positioning comprises mounting an evaporator of a vapor compression cycle system along the air exhaust passageway.

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61. The method of claim 60, further comprising mounting a condenser of the vapor compression cycle system along an air inlet passageway.

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62. The method of claim 61, further comprising pneumatically coupling the air exhaust passageway to the air inlet passageway via a conduit to form a continuous airflow loop through the laundry enclosure and the conduit.

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63. A program for controlling a laundry cleaning device, comprising:
a machine readable medium;
a washing control routine stored on the machine readable medium and adapted to control a washing cycle using a cleaning fluid; and

a drying control routine stored on the machine readable medium and adapted to control a drying cycle operating a heating device to vaporize the cleaning fluid and operating a cooling device to condense vaporized cleaning fluid.

5 64. The program of claim 63, comprising control parameters configured for substantially optimizing time and energy usage of the washing and drying cycles for a home application.

10 65. The program of claim 63, comprising control parameters having a target heated-air temperature greater than about 100 degrees Fahrenheit for the heating device.

15 66. The program of claim 63, comprising control parameters having a target heated-air temperature between approximately 130 and 170 degrees Fahrenheit for the heating device.

16 67. The program of claim 63, comprising control parameters having a target cooled-air temperature less than about 70 degrees Fahrenheit for the cooling device.

20 68. The program of claim 63, comprising control parameters having a target cooled-air temperature between approximately 50 and 80 degrees Fahrenheit for the cooling device.

25 69. The program of claim 63, comprising control parameters having a target airflow rate of about 150 to 300 cubic feet per minute through a laundry enclosure of the laundry cleaning device.